A verbal paper by Prof. G. H. Perkins, on certain strange stone implements from Vermont, consisted chiefly of general statements concerning Vermont archeology; and the exhibition of a considerable collection of peculiar implements, with remarks upon their character and rarity. The speaker mentioned the fact, that the evidences of a former occupation of the region, more extensive than has been supposed, were increasingly convincing; and also that two distinct layers, one much below the other, afforded relics.

A very excellent account of the Cahokia mound and its surroundings, with the results of his own extensive explorations, was given by Mr. W. McAdams; and many very striking resemblances to the Mexican pyramids were brought out. The writer showed by drawings and diagrams the forms and position of many mounds, which are found in the region of Cahokia in immense numbers. Mr. F. W. Putnam gave some very practical and detailed directions as to the proper exploration of mounds, pleading earnestly for thorough work in all explorations; and illustrated its value by several examples drawn from his own recent investigations. The last paper read was by Rev. Mr. Dorsey, who presented a most interesting collection of suggestive facts respecting primary classifiers in Dhegiha and cognate languages.

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## *THE APPLICATION OF SCIENCE TO THE PRODUCTION AND CONSUMPTION OF FOOD.*[1]

MR. ATKINSON, in his opening remarks, said that he presumed the business of the association was not to popularize science by lowering its standard, but to bring the progress of science and art in their application to human welfare prominently before the public. While giving full credit to those who engage in the pursuit of knowledge for its own sake, yet Mr. Atkinson would believe that their work must finally rest for its justification upon its influence on the material welfare of the race. To this end the address was devoted to the future applications of science to the production and transportation of food. In preparing the address, the speaker endeavored to bring into clear view the vast changes, both social and scientific, which have rendered the production and distribution of all commodities, especially of food, so much easier and more equitable during the present generation than ever before, and, to some extent, to show what further progress might be immediately before us. He endeavored to demonstrate, that, in the generation which will have passed between the end of our civil war to the beginning of the next century, greater progress will have been made in the way of material welfare than in any preceding period of the same length.

It is commonly assumed that the invention of the steam-engine, spinning-frame, and power-loom made greater changes in the production and distribution of wealth in a single half-century than have ever occurred before or since; but it will be observed that the forces of steam were limited during the first half of the century to reducing the cost of labor in making textile fabrics and in working mills. It is only in recent years that it has exercised any great influence on the production or distribution of food. However important clothing may be, it is relatively unimportant as compared to food in the proportion of labor required for its production.

All the available statistics prove that to the working people of this country the cost of food measured in money, including drink for whatever it is worth, is not less than three times the cost of clothing; and the proportion is even greater for the working people of Europe. How much greater this disparity must have been twenty-five years since, when the value of grain was exhausted by transportation over a hundred and fifty miles of common highway! If, then, one-half the struggle for life, measured in money, and more than one-half when measured by the work of the household of the prosperous mechanic, is the price paid for food, it is evident that the inventions and improvements of the last twenty years, which have been mainly directed to the increased production and cheap distribution of grain and meat, have affected human welfare in even greater measure than the inventions of the last century.

After referring to the advantages to the commerce of the United States, owing to the vast area over which free competition is possible, Mr. Atkinson enumerated various changes which have been brought about by the application of more scientific methods in machinery, and by the discoveries in the last twenty-five years: he referred to the displacement of the paddle-wheel by the screw-propeller; to the perfection of the compound steam-engine; to the discovery of oil-wells; and to the growing use made of electricity.

To this picture of prosperity, there is another side: vast progress has been made in individual wealth and common welfare; the time necessary to be devoted to the struggle for life has been reduced. But, great as our progress has been, and huge as our abundance now appears to be, yet the fact remains that the average product to each person in this most prosperous country, measured in money at the point of final distribution for final consumption, does not exceed fifty to fifty-five cents per capita per day; and our whole accumulated wealth, aside from land, does not exceed two, or, at the utmost, three years' production. After we have provided for the support of the government, for taxation, each average person must find shelter, and be supplied with food and clothing out of what forty to forty-five cents will buy. Moreover, whenever any great invention displaces common laborers whose development has not been of such a kind as to fit them for other work, they suffer for the time. The Yankee boy of former days, who attended the common school for three or six months in the year, and during the rest of the year was a jack-at-all-trades, was thereby enabled to

[1] Abstract of an address delivered before the section of economice science of the American association for the advancement of science, at Ann Arbor, Aug. 26, by EDWARD ATKINSON, Esq., of Boston, vice-president of the section.

become a master of any trade which he might afterwards choose. Such is not the case at present. From the census of 1880 it appears that out of every thousand persons engaged in gainful occupation, three hundred and twelve were classed as common laborers. This proportion was doubtless increased between 1880 and 1882 by immigration, and it is this class which suffered from diminished railroad-building during the last three years. The true remedy can only exist in the development of versatility and manual dexterity, and of capacity on the part of the poorest child in the community to take advantage of all opportunities which may offer.

With respect to the applications of science, crude as they are in respect to agriculture, they assure an abundance for any increased population during the present century. With respect to the mechanism of distribution, the cost has been reduced so that there is little margin for further saving. In the conversion of crude materials into forms ready for consumption, the field for improvement is still a broad one. In wholesale traffic, as well as in retail distribution, of perishable commodities, there is a waste; and in the science of consumption, almost no progress has been made.

Again recalling, however, that to common laborers their food constitutes sixty per cent of the cost of life, it will be obvious, that, if we can show them how to maintain themselves in full vigor at the cost of thirty or forty per cent of their ordinary income, we shall have done good service. Prof. W. O. Atwater of Middletown, Conn., has prepared a number of tables, in one of which it is shown, that, if we buy protein in a sirloin of beef at twenty-five cents a pound, we pay one dollar a pound for it; whereas, if we seek for protein in oatmeal or cornmeal, we pay twelve to fourteen cents for it. Mr. Atkinson praised for their cheapness the Yankee dishes of fried fish-balls, and pork and beans; and also the weekly ration of the southern negro, — a peck of meal, and three and a half pounds of bacon; which, probably, supplies the cheapest subsistence known. The rice of the east may cost less in money, but is deficient in the nutrients necessary for full vigor.

While the American could live cheaply on oatmeal, or pork and beans, yet he would not willingly do so, but would wish for meat; and it is to the cheapening of the cost of meat, rather than to the reduction of its consumption, that there is need of attention. Mr. Atkinson referred to the partially abandoned lands of the New-England States, as probably capable of producing, if properly fertilized, beef at a cheaper rate than is now done by cruder methods in Texas, adding the cost of transportation to this market.

Mr. Atkinson based his scheme upon the claim of Mr. Farrish Furman of Georgia, that he is able to raise two and a half bales of cotton to the acre on abandoned cotton lands when suitably fertilized with Stassfurt potash, and the phosphate rocks of South Carolina. He would bring the cotton-seed meal to Massachusetts, there feeding it, and thus converting the minerals into fertilizing elements to be used on the barren lands of New England to raise Indian corn, which should be used as pitted fodder or ensilage for the cattle. If this proposition can be sustained, it may happen that when the population of the United States of 1880 shall have doubled, an area of land no larger than that needed in 1880 will be required to sustain the people of that day.

At the close of his address, Mr. Atkinson presented a number of statistical tables showing the cost of life of various classes of people, mostly operatives or mechanics, and some tables showing the cost of maintaining inmates of public institutions. The investigation of the statistics does not increase Mr. Atkinson's faith in the law of population propounded by Malthus, or Ricardo's theory of rent, or the so-called law of diminished returns from land.

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## *PROCEEDINGS OF THE SECTION OF ECONOMIC SCIENCE AND STATISTICS.*

THE opening paper in this section was by Mr. Henry E. Alvord of Houghton Farm, New York, upon the relative values of human foods, and had especial interest, as forming in a degree a continuation of some of the interesting considerations contained in Mr. Atkinson's vice-presidential address. The author's comparisons of different articles of human food were based upon their average chemical composition alone, it being his belief that "we are so much in the dark on the questions of the actual proportions of digestibility in different forms of food, that it is safer to drop this factor than to include it."

Selecting as his basis of comparison for animal food, average ox-beef (flesh free from bone) at sixteen cents per pound, and for vegetable food, potatoes at one cent per pound, and rating animal fat at twelve cents per pound, and the carbohydrates of vegetables at four cents per pound, he arrived at the following money values, per pound, for the three classes of nutrients: —

| | Protein. | Fat. | Carbohydrates. |
|---|---|---|---|
| Animal . . . . . | 72 cents | 12 cents | 7 cents. |
| Vegetable . . . . . | 10 " | 7 " | 4 " |

Based upon these valuations, elaborate tables were presented, showing the nutritive value expressed in money, of all important articles of human food in comparison with their cost. The investigation was undertaken with particular reference to the food value of dairy products, and the results show that skim-milk, butter-milk, and cheese, at usual retail prices, furnish a given amount of nutriment more cheaply than any other articles on the list, being approached in this respect only by fresh mackerel and dried cod-fish. Milk, on this scale, sells for about its nutritive value; while butter costs two or three times its real food value, and often more. "What shall be said," continued the speaker, "of domestic economy in America, where more butter and less cheese are consumed per capita than in any other nation in our zone? And what of the government of some of our great cities, where boards of health absolutely prohibit the sale of skimmed milk, and actually destroy all that can be found?"